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Coupling of multiple plasma stages for a Proton Driven Plasma Wakefield Accelerator

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Particle accelerators have many important applications, one of them being the study of fundamental particles and the forces that act between them. Although we have a good understanding of the current Standard Model, we also know that there is still a lot to learn, and to do so we need particles with more energy, and thus we need to improve current particle accelerators.

The use of plasmas in particle accelerators has been proposed by many, as they are able to support larger electric fields which means that they are able to transfer more energy to particles. At CERN, the AWAKE experiment is developing a plasma based accelerator by using a proton beam to create these large electric fields, which we call plasma wakefields.

Some of the advantages of using proton beams to create plasma wakefields is that available proton beams have a lot of energy, and thus are able to create large electric fields, but available proton beam's size is too large for these wakefields to efficiently accelerate other particles, so the AWAKE experiment needs to couple two plasma stages (one for reducing the beam's size and the other to create the accelerating fields) in order to create an efficient accelerator.

The main goal will be to use computer simulations to study the implications of coupling these two stages and study the main effects on the accelerating fields.

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